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PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(Article 36 and Rule 70 of the PCT)

File reference of the applicant or of the agent	**FOR FOLLOW-UP** see the notification for transmitting the international preliminary examination report (form PCT/IPEA/416)	
International Application No. PCT/FR 03/50024	International Filing Date *(mo./day/yr.)* 08/04/2003	Priority Date *(month/day/year)* 08/05/2002
International Patent Classification (IPC) or both national classification and IPC G06F 17/30		
Applicant LTU TECHNOLOGIES		

1. The present international preliminary examination report, prepared by the department in charge of international preliminary examinations, is being sent to the applicant in accordance with Article 36.

2. This REPORT consists of 5 pages, including the present cover page.

   [x] It is accompanied by ATTACHMENTS, i.e., pages of the specification, claims or drawings which have been amended and which serve as a basis of the present report or pages containing corrections that have been made to the department in charge of international preliminary examinations (see Rule 70.16 and Directive 607 of the Administrative Directives of the PCT).

   These attachments consist of 12 pages.

3. The present report contains indications and the corresponding pages relative to the following points:
   - I [x] Basis of the opinion
   - II [ ] Priority
   - III [ ] Absence of formulation of an opinion as to novelty, inventive activity and the possibility of industrial application
   - IV [ ] Absence of unity of the invention
   - V [x] Reasoned declaration according to Rule 66.2(a)(ii) as to novelty, inventive activity and possibility of industrial application; citations and explanations in support of this declaration
   - VI [ ] Certain documents cited
   - VII [ ] Irregularities in the international application
   - VIII [ ] Observations relative to the international application

Date of submission of the request for international preliminary examination 03/05/2004	Date of completion of the present report 10/05/2004
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Form PCT/IPEA/409 (Cover page) (January 2004)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT **International Application No. PCT/FR03/50024**

I. Basis of Report

1. As concerns the **elements** of the international application *(the replacement pages that were sent to the receiving office in response to an invitation made in accordance with Article 14 are considered, in the present report, to be "initially filed" and are not attached to the report because they do not contain any changes (Rules 70.16 and 70.17))*:

Specification, Pages
1-27 as initially filed

Claims, Nos.
1-13 received on Sept. 1, 2004 by fax

Drawings, Sheets
1/8-8/8 as initially filed

2. As concerns the **language**, all the elements indicated above were available to the department or were sent to it in the language in which the international application was filed, unless indicated otherwise under this point.

These elements were available to the department or were sent to it in the following language: , which is:

[ ] the language of a translation sent for the purposes of the international search (according to Rule 23.1(b)).
[ ] the language of publication of the international application (according to Rule 48.3(b)).
[ ] the language of the translation sent for the purposes of the international preliminary examination (according to Rule 55.2 or 55.3).

3. As concerns the **sequences of nucleotides or amino acids** disclosed in the international application (if need be), the international preliminary examination was carried out on the basis of the listing of the sequences:

[ ] contained in the international application, in written form.
[ ] filed with the international application, in a form decipherable by computer.
[ ] sent later to the department, in written form.
[ ] sent later to the department, in a form decipherable by computer.
[ ] The declaration, according to which the listing of sequences in writing and provided later does not go beyond the disclosure made in the application as filed, has been provided.
[ ] The declaration, according to which the information recorded in a form decipherable by computer are identical to that of the listings of sequences submitted in writing, has been provided.

4. The amendments led to the invalidation:

[ ] of the specification, pages:
[ ] of the claims, Nos.:
[ ] of the drawings, sheets:

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5. [ ] The present report was written without regard to (some of) the amendments, which were considered to go beyond the preamble of the invention as it was filed, as is indicated below (rule 70.2(c)):

(Any replacement page containing amendments of this nature must be indicated under point 1 and attached to the present report.)

6. Additional observations, if need be:

V. Reasoned declaration according to Article 35(2) as to the novelty, inventive activity and the possibility of industrial application; citations and explanations in support of this declaration

1. Declaration

Novelty	Yes:	Claims	1-13
	No:	Claims	
Inventive activity:	Yes:	Claims	1-13
	No:	Claims	
Possibility of industrial application	Yes:	Claims	1-13
	No:	Claims	

2. Citations and explanations
see separate sheet

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EXAMINATION REPORT - SEPARATE SHEET

Concerning point I
Declaration on the basis of the report; documents used as the basis of the examination;

1. The new claims 1-13, submitted by fax dated August 31, 2004, received on September 1, 2004, with erroneous application number FR03/50025, were considered as forming the basis of the examination after confirmation of the error by the applicant (fax dated September 28, 2004).

Concerning point V
Reasoned declaration according to Article 35 as to the novelty, inventive activity and the possibility of industrial application; citations and explanations in support of this declaration

1. Reference was made to the following document:

D1: EP 0878767 (Hitachi Ltd.)

2. The document D1 is considered to be the closest prior art. It describes a system and a method for detecting specific audiovisual sequences within any video sequences. Characteristic vectors are extracted from each image of the specific sequence, and then stored as a reference index. The corresponding characteristics of the current sequence[s] are then extracted in order to form a current index, which is itself compared to the reference index, which makes the detection possible.

A video sequence consisting of only one image is considered as being a single image.

One problem with D1 is that the method proposed remains not very robust during certain types of photometric transformations (example: high-frequency noise, changing the contrast or brightness) since the characteristics to be compared are directly linked with the pixel values of the image.

The solution of the invention lies in the selection of a fast comparison distance to be evaluated and having the advantage of calculating the capacity to predict the pixel values of an image X as a function of those of an image Y, without a particular hypothesis about the nature of the photometric transformations linking X to Y, which makes the detection more robust. The comparison distance is based on the use of the reference marginal entropy, the current marginal entropy and the entropy of the bidimensional histogram as defined in the independent method claim 1 and system claim 7.

Form PCT/separate sheet/409 (sheet 1) (OEB-April 1997)

None of the currently available prior-art documents, alone or combined, reveals or suggests the technical features forming the solution of the application.

Therefore, the claims 1 through 13 meet the criteria of novelty and of inventive activity of Article 33(1), (2) and (3) PCT.

C. Fournier

CLAIMS

1. Method for identifying a said specific image (11) and/or a said specific audiovisual sequence (2) within any said flow (3) of said images (6) or said audiovisual sequences (7), and in particular with the prospect of being able to identify a said proprietary image (4) within the said flow (3) and/or of being able to identify a plurality of said proprietary audiovisual sequences (5) within the said flow (3);

the said method comprising the step of calculating, for each said image (6), an index appearing in the form of a said ordered and finite set (21) of values, and in particular in the form of a said characteristic vector (9), encoding the content of the said image (6); the said index calculation process being hereinafter called the said indexing process (39);

the said method comprising:

- the step of calculating a said reference index (10), using the said indexing process (39) for the said specific image (11), or

- the step of extracting said reference indexes (10) from the said specific audiovisual sequence (2), so as to form a said reference set (30) of said reference indexes (10);

in such a way that said reference indexes (10) characteristic of the said specific image (11) and/or of the said specific audiovisual sequence (2) are thus obtained;

the said method additionally comprising the step of calculating an index for the said current images (13) of the said flow (3), using the said indexing process (39) for the said current images (13) of the said flow (3); the said index being hereinafter called the said current index (14);

the said method additionally comprising the step of comparing the said reference indexes (10) with the said current index (14) of the said current image (13) of the said monitored flow (3);

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characterized in that, the said method being such that, the said indexes appearing in the form of said ordered and finite sets (21a, 21b) of values identified, in the said reference index (10) and the said current index (14), by a said system of coordinates (22), it additionally comprises the following steps:

- the step of defining, for a said given coordinate (24) of the said system of coordinates (22), a said pair of values (25, 26), of which:

- the said first value (25) is the value appearing in the said reference index (10) associated with the said given coordinate (24), and of which

- the said second value (26) is the value appearing in the said current index (14) associated with the said given coordinate (24),

- the step of calculating the said bidimensional histogram (27) of the said pairs of values (25, 26) obtained for all the coordinates of the said system of coordinates (22) of the said reference index (10) and of the said current index (14),

- the step of calculating the discrete entropy of the said bidimensional histogram, hereinafter called the said entropy of the bidimensional histogram (28),

the step of calculating the discrete entropy of the distribution of the values of the said reference index (10) or of the said current index (14); the said entropy being hereinafter called the said reference marginal entropy (50a) or the said current marginal entropy (50b);

in such a way that the comparison time is thus optimized;

in such a way that it is thus possible to add this marginal entropy value to the said index;

- the step of calculating a said comparison distance (29) between a said reference index (10) and a said current index (14), using the said reference marginal entropy (50a), the said current marginal entropy (50b) and the said entropy of the bidimensional histogram (28);

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- the step of detecting a said specific image (11) within a said flow (3), thanks to the said comparison distance, with great precision and extremely fast, while being robust during major photometric alterations.

2. Method in accordance with claim 1; the said method being such that, to calculate an index of a said image (6), and in particular a said reference index (10) and/or a said current index (14), it comprises the step of resampling the said image (6) as an image with fixed dimensions in advance; the said resampled image being hereinafter called the said normalized image (16);

the said method additionally comprising, if the said image (6) is a color image comprising levels of colors, the step of converting the said levels of colors of the said image (6) to be resampled to levels of gray beforehand;

the said normalized image (16) being represented by a said matrix (19) of said pixel values (17) after discrete quantization of the said pixel values;

the said method additionally comprising the following steps:

- the step of arranging the said values according to a predetermined running order of the said positions (18) in the said matrix (19), and in particular by concatenating the said values of each line of the said matrix (19) in the form of a said characteristic vector (9), so as to obtain the said index.

3. Method in accordance with one of the claims 1 and 2; the step of calculating a said comparison distance (29) between a said reference index (10) and a said current index (14) being performed by forming the ratio between the sum of the said reference marginal entropy (50a) and of the said current marginal entropy (50b) reduced by the said entropy of the bidimensional histogram (28) as the numerator and the sum of the said reference marginal entropy (50a) and the said current marginal entropy (50b) as the denominator.

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4. Method in accordance with claim 3; the said method being such that, to extract the said reference indexes (10) of the said specific audiovisual sequence (2) from the said specific audiovisual sequence (2), it additionally comprises the following steps:

- the step of initializing a said reference set (30) containing the said reference indexes (10) of the said specific images (11) with the said reference index (100) of the said first specific image (110) of the said specific audiovisual sequence (2); the said reference index (100) of the said first specific image (110) of the said specific audiovisual sequence (2) constituting the first reference index of the said reference set (30);

the said method additionally comprising:

- (a) the step of calculating, for each said specific image (11) of the said specific audiovisual sequence (2), a said temporary current index (31) and of calculating a said comparison distance (29) between the said temporary current index (31) and the said last reference index (32) added to the said reference set (30),

- (b) the step of comparing the said comparison distance (29) between the said temporary current index (31) and the said last reference index (32) added to the said reference set (30) to a said predetermined threshold SE (33);

- (c) the step of adding the said temporary current index (31) to the said reference set (30), if the said comparison distance (29) exceeds the said predetermined threshold SE (33); the said temporary current index (31) becoming the said last reference index (32) of the said reference set (30);

the said method additionally comprising the step of repeating the steps (a) through (c) up to the end of the said specific audiovisual sequence (2).

5. Method in accordance with any of the claims 1 through 4; the said method being such that, for comparing the said reference indexes (10) with the said current index (14) of the said current image

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(13) of the said monitored flow (3), it additionally comprises the step of comparing the said comparison distance (29) to a said predetermined threshold SF (65);

in such a way that in the case of any said flow (3) of said images (6) the said specific image (11) is detected provided that the said comparison distance (29) between the said reference index (10) of the said specific image (11) and the said current index (14) is less than the said predetermined threshold SF (65).

6. Method in accordance with claim 4; the said method being more particularly designed for detecting a said specific audiovisual sequence (2) within any said flow (3) of said audiovisual sequences (7); the said method comprising the following steps:

- (a) the step of initializing a said variable T (34) at -1, the step of initializing a said variable D (35) at 0,

- (b) the step of calculating, for each said reference index (10) of the said reference set (30), the said comparison distance (29) between the said reference index (10) of the said reference set (30) and the said current index (14); in such a way that if the said comparison distance (29) is less than a said predetermined threshold SD (59), the said variable D (35) is increased by one; the said condition being hereinafter called the said condition for detecting said reference indexes (10);

the said method being such that the moment when the first said reference index (10) of the said reference set (30) of the said specific audiovisual sequence (2) meets the said detection condition is hereinafter called the moment of the first detection;

the method additionally comprises the following steps:

- (c) the step of assigning to the said variable T (34) the time elapsed since the said moment of the first detection if the said variable D (35) is different from zero,

- (d) the step of repeating step (b) until the said variable D (35) reaches the said predetermined threshold SD (59); or of repeating step (a) if the said variable T (34) exceeds a said predetermined threshold ST (60),

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- (e) the step of detecting the said specific audiovisual sequence (2) if the said variable D (35) reaches the said predetermined threshold SD (59).

7. System for identifying a said specific image (11) and/or a said specific audiovisual sequence (2) within any said flow (3) of said images (6) or said audiovisual sequences (7), and in particular with the prospect of being able to identify a said proprietary image (4) within the said flow (3) and/or of being able to identify a plurality of said proprietary audiovisual sequences (5) within the said flow (3);

the said system comprising:

- said first calculation means (38) for calculating a said reference index (10) for the said specific image (11), using a said indexing process (39), or

- said first computer analysis means (40) for extracting said reference indexes (10) from the said specific audiovisual sequence (2), so as to form a said reference set (30) of said reference indexes (10);

the said system additionally comprising:

- said reception means (41) for receiving the said flow (3) of said images (6) or said audiovisual sequences (7) comprising at least one said specific image (11) and/or at least one said specific audiovisual sequence (2),

- said computer processing means (42) for digitizing the said flow (3) of said images (6) or said audiovisual sequences (7);

the said system being characterized in that, the said reference index (10) appearing in the form of a said ordered and finite set (21a) of said values (20a), and in particular in the form of a said characteristic vector (9a), encoding the content of the said specific image (11);

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in such a way that a said reference index (10) characteristic of the said specific image (11) and/or of the said specific audiovisual sequence (2) is thus obtained;

the said system additionally comprising:

- said second calculation means (43) for calculating a said current index (14) for said current images (13) of the said flow (3), using the said indexing process (39) for the said current images (13) of the said flow (3);

the said current index (14) appearing in the form of a said ordered and finite set (21b) of values, and in particular in the form of a said characteristic vector (9b), encoding the content of the said current image (13);

the said system additionally comprising:

- said comparison means (44) for comparing the said reference index (10) of the said specific image (11) with the said current index (14) of the said current image (13) of the said monitored flow (3);

the said first calculation means (38) additionally comprising said reference processing means (49a) for calculating the discrete entropy of the distribution of the values of the said reference index (10); the said entropy being hereinafter called the said reference marginal entropy (50a);

in such a way that the comparison time is thus optimized;

in such a way that this said reference marginal entropy value (50a) can thus be added to the said reference index (10);

the said second calculation means (43) additionally comprising said current processing means (49b) for calculating the discrete entropy of the distribution of the values of the said current index (14); the said entropy being hereinafter called the said current marginal entropy (50b);

in such a way that the comparison time is thus optimized;

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in such a way that this current entropy value can thus be added to the said current index (14).

the said system being such that, the said reference indexes (10) and the said current indexes (14) appearing in the form of said ordered and finite sets (21a, 21b) of values identified, in the said reference index (10) and the said current index (14), by a said system of coordinates (22);

it additionally comprises said third calculation means (52) for:

- defining, for a said given coordinate (24) of the said system of coordinates (22), a pair of said values (25, 26), of which the said first value (25) is the value appearing in the said reference index (10) associated with the said given coordinate (24), and of which the said second value (26) is the value appearing in the said current index (14) associated with the said given coordinate (24),

- calculating the said bidimensional histogram (27) of the said pairs of values (25, 26) obtained for all the coordinates of the said system of coordinates (22) of the said reference index (10) and the said current index (14),

- calculating the discrete entropy of the said bidimensional histogram, hereinafter called the said entropy of the bidimensional histogram (28),

- calculating a said comparison distance (29) between a said reference index (10) and a said current index (14), using the said reference marginal entropy (50a), the said current marginal entropy (50b) and the said entropy of the bidimensional histogram (28),

- detecting a said specific image (11) within a said flow (3) with great precision and extremely fast, while being robust during major photometric alterations.

8. System in accordance with claim 7; the said system being such that the said first calculation means (38) for calculating a said reference index (10) of a said specific image (11) comprise:

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- said sampling means (45) for resampling the said specific image (11) as a resampled specific image with fixed dimensions in advance,

- said means for discrete quantization (46) of the pixel values of the said specific image (11) resampled in such a way that the said specific image (11) resampled is represented by a said matrix (19) of the said pixel values (17), after discrete quantization;

- said sequencing means (47) for arranging the said pixel values (17) according to a predetermined running order of the said positions (18) in the said matrix (19), and in particular by concatenating the said values of each line of the said matrix (19) in the form of a said characteristic vector (9a), so as to obtain the said reference index (10);

the said system additionally comprising, if the said specific image (11) is a said color image (6) comprising levels of colors, said conversion means (48) for converting the said levels of colors of the said specific image (11) to be resampled to levels of gray beforehand.

9. System in accordance with any of the claims 7 and 8; the said system being such that the said second calculation means (43) for calculating a said current index (14) of a said current image (13) comprise:

- said sampling means (45) for resampling the said current image (13) as a said current image (13) with fixed dimensions in advance,

- said means for discrete quantization (46) of the pixel values of the said current image (13) in such a way that the said resampled current image (13) is represented by a said matrix (19) of the said pixel values (17), after discrete quantization;

- said sequencing means (47) for arranging the said pixel values according to a predetermined running order of the said positions (18) in the said matrix (19),

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and in particular by concatenating the said values of each line of the said matrix (19) in the form of a said characteristic vector (9b), so as to obtain the said current index (14);

the said system additionally comprising, if the said current image (13) is a said color image (6) comprising levels of colors, said conversion means (48) for converting the said levels of colors of the said current image (13) to be resampled to levels of gray beforehand.

10. System in accordance with one of the claims 7 through 9, in which the third calculation means calculate the said comparison distance (29) between a said reference index (10) and a said current index (14), forming the ratio between the sum of the said reference marginal entropy (50a) and of the said current marginal entropy (50b) reduced by the said entropy of the bidimensional histogram (28) as the numerator and the sum of the said reference marginal entropy (50a) and the said current marginal entropy (50b) as the denominator.

11. System in accordance with claim 10; the said system being such that, to extract the said reference indexes (10) of said specific audiovisual sequence (2) from the said specific audiovisual sequence (2), made up of said specific images (11), it additionally comprises said fourth calculation means (53) using a said calculation algorithm (54) comprising a step of initializing a said reference set (30) containing the said reference indexes (10) of the said specific images (11) with the said reference index (100) of the said first specific image (110) of the said specific audiovisual sequence (2); the said reference index (100) of the said first specific image (110) of the said specific audiovisual sequence (2) constituting the first reference index of the said reference set (30);

the said calculation algorithm (54) additionally comprising:

- (a) the step of calculating, for each said specific image (11) of the said specific audiovisual sequence (2), a said temporary current index (31) and of calculating a said comparison distance

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(29) between the said temporary current index (31) and the said last reference index (32) added to the said reference set (30);

- (b) the step of comparing the said comparison distance (29) between the said temporary current index (31) and the said last reference index (32) added to the said reference set (30) to a said predetermined threshold SE (33);

- (c) the step of adding the said temporary current index (31) to the said reference set (30), if the said comparison distance (29) exceeds the said predetermined threshold SE (33); the said temporary current index (31) becoming the said last reference index (32) of the said reference set (30);

the said calculation algorithm (54) additionally comprising the step of repeating the steps (a) through (c) up to the end of the said specific audiovisual sequence (2).

12. System in accordance with any of the claims 10 or 11; the said system being such that the said third calculation means (52) compare the said comparison distance (29) between the said reference indexes (10) and the said current index (14) of the said current image (13) of the said monitored flow (3) to a said predetermined threshold SF (65);

in such a way that in the case of any said flow (3) of said images (6), the said specific image (11) is detected provided that the said comparison distance (29) between the said reference index (10) of the said specific image (11) and the said current index (14) is less than the said predetermined threshold SF (65).

13. System in accordance with claim 11; the said system being more particularly designed for detecting a said specific audiovisual sequence (2) within any said flow (3) of said audiovisual sequences (7);

the said system comprising said initialization means (57) for loading:

the value -1 in a said first register T (55), and

the value 0 in a said second register D (56);

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the said system additionally comprising said fifth calculation means (58) for calculating, for each said reference index (10) of the said reference set (30), the said comparison distance (29) between the said reference index (10) of the said reference set (30) and the said current index (14); in such a way that if the said comparison distance (29) is less than a said predetermined threshold SD (59), the said second register D (56) is increased by one; the said condition being hereinafter called the condition for detecting said reference indexes (10);

the system being such that the moment when the said first reference index (10) of the said reference set (30) of the said specific audiovisual sequence (2) meets the said detection condition is hereinafter called the moment of the first detection;

the said fifth calculation means (58) being equipped for loading in the said first register T (55) the time elapsed since the said moment of the first detection if the value stored in the said second register D (56) is different from zero;

the said fifth calculation means (58) being equipped for repeating the said calculation of the said comparison distance (29), until the value stored in the said second register D (56) reaches the said predetermined threshold SD (59), or for repeating the use of the said initialization means (57) if the value stored in the said first register T (55) exceeds a said predetermined threshold ST (60),

in such a way that the said specific audiovisual sequence (2) is detected if the value stored in the said second register D (56) reaches the said predetermined threshold SD (59).

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